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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/759,312	01/12/2001	Yoshihiro Ueta	299002051800	1784
25226	7590	12/19/2003	EXAMINER	
MORRISON & FOERSTER LLP			MULPURI, SAVITRI	
755 PAGE MILL RD			ART UNIT	PAPER NUMBER
PALO ALTO, CA 94304-1018			2812	

DATE MAILED: 12/19/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/759,312

Applicant(s)

UETA ET AL.

Examiner

Savitri Mulpuri

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 September 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 and 3-13 is/are pending in the application.
- 4a) Of the above claim(s) 8-11 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-7,12-13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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DETAILED ACTION

This application is in response to the applicant's amendment filed on 9/18/2003

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3-7, 12, 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Kimura et al (US 6,201,823 in combination with Zauner et al (publication by materials research society).

Kimura et al discloses a compound semiconductor light emitting device having semiconductor multi layer structure on sapphire substrate, wherein multi layer structure comprises acceptor doping layer and evenly formed of multi quantum well active layer "107" with seven period alternating quantum well and barrier layers of GaInN formed on n-AlGaIn cladding layer "105" and n-GaN optical guide layer "106". Kimura further discloses magnesium doped P-AlGaIn cladding layer "108" and magnesium doped p-type GaN optical guide layer "109" (see background invention). Kimura et al discloses in the background invention, even layers of multiple layers of GaN are formed on flat surface of the sapphire substrate (see fig. 1 and fig. 2 and related description). Kimura does not disclose the starting substrate is GaN substrate having tilted crystal orientation from <00001> direction by an angle which is equal to or greater

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than about 0.5 and less than or equal to 2 degrees. Inherently active layer is formed from the substrate by a distance greater than or equal to 1 micron.

Zauner et al teaches growing GaN layer on GaN substrate as a homo-epitaxial growth at tilted angle of 0, 2, and 4 degrees to obtain GaN layers with two orders of magnitude reduction in density of grown hillocks as compared to homo-epitaxial films grown on $\langle 0001 \rangle$ direction or hetero- epitaxial growth such GaN grown on sapphire substrate. Zauner particularly teaches obtaining smoother layers due to suppression of formation hexagonal pyramids of GaN growth because GaN is grown on GaN substrate with off-angle orientation from $\langle 0001 \rangle$ direction (see abstract and the introduction section). Zauner et al compared the results GaN grown on GaN substrate off-oriented from $\langle 0001 \rangle$ direction with GaN grown on GaN substrate with $\langle 0001 \rangle$ orientation and hetero-epitaxial growth such as GaN grown on sapphire substrate with $\langle 0001 \rangle$ orientation (see results and discussions). It would have been obvious to one of ordinary skill in the art to replace sapphire substrate with GaN substrate having off-orientation from $\langle 0001 \rangle$ direction for the benefit of obtaining smoother layers with less density of grown hillocks by two orders of magnitude compared to homo- epitaxial growth of GaN on GaN with $\langle 0001 \rangle$ direction and hetero epitaxial growth of GaN on sapphire $\langle 0001 \rangle$ direction. Modified invention of Kimura, as modified by the teaching Zauner, would have active layer with surface roughness which is equal to or less than a thickness of well layer in the quantum well structure because same technique of homo-epitaxial growth of GaN grown on GaN substrate with tilt angle of 0, 2, 4 degrees tilted away from $\langle 0001 \rangle$ direction to $\langle 11-20 \rangle$ or $\langle 1-100 \rangle$.

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Applicant's arguments filed on 9/18/2003 have been fully considered but they are not persuasive. Applicant argues that there is no motivation combining the Zauner teaching with teaching of Kimura. Replacing sapphire with GaN of Zauner results less mismatch between substrate and epitaxial layer because both substrate and epitaxial layer would be formed of GaN. Applicant argues that Kimura and Zauner both fails to teach tilting angle from 0.5 to 2 degrees from $\langle 0001 \rangle$ direction. Zauner teaches tilting the direction 2 degrees from $\langle 0001 \rangle$ direction, which is same as instant limitation less than or equal to 2 degrees from $\langle 0001 \rangle$. Applicant argues that the feature of tilting in the instant invention varies the growing condition of the nitride semiconductor layer provided on the substrate, thereby reducing In transportation and In coagulation with active layer. However in instant claim active layer can be read as broad as GaN or AlGaIn because x and y are in the range between 0 to 1.

Applicant argues that Kimura teaches tilting the 0 to 10 degrees is for the purpose of the growing current block layer. Applicant argues that angel -5 to 5 degrees to $\langle 11-20 \rangle$ or $\langle 1-100 \rangle$ to rotate the stripe marks within plane of the substrate. However Kimura is not relied on the tilt angle and relied on the teaching multi layer structure.

Applicant argues that in instant invention, GaN substrate slightly tilted in the range 0.5 to 2 degrees against $\langle 0001 \rangle$ provides the result that active layer constituting an integral layer construction having several nm period is formed evenly, to the extent less than an individual layer thickness of the well type and barrier layer. Modified invention of Kimura modified by the

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teach of Zauner, which teaches tilting GaN substrate in 2 degrees would give smoother layers with less density of grown hillocks by two order of magnitude because of homoepitaxial growth i.e GaN epitaxial layer grown on GaN substrate.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to S. Mulpuri whose telephone number is 703-272-1677. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.


SAVITRI MULPURI
PRIMARY EXAMINER